

NEW GENERA AND SPECIES OF NEMATODE WORMS

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This paper contains descriptions of several new genera and species of parasites collected from Asian and American vertebrates. One species, *Bourgelatiooides traguli*, new genus, new species, belongs to the suborder Strongylata, while the others all belong to the suborder Spirurata. One of the latter, *Filariopsis arator*, has been placed in a new family, Filariopsidae.

BOURGELATIOIDES, new genus

Generic diagnosis.—Oesophagostominae: Mouth capsule cylindrical, shallow, with thick chitinous walls, divided into anterior and posterior compartments. Posterior end of capsule attached to the cuticle by a chitinous ring and anterior portion of capsule separated from posterior portion by a crown of small leaflets. Anterior border of capsule without leaf-crown, but with four large papillae in the wall. Head end of body delimited in esophageal region by a groove and an overlying flap of cuticle entirely encircling the body. Bursa well developed, the large dorsal ray split for about half its length, each branch again bifurcated; externodorsal very large; posterolateral and mediolateral closely approximated; ventrals closely approximated but split almost to the common base. Spicules equal, moderately long, winged, each terminated by a long coiled filament. Vulva in posterior part of body. Tail of female bluntly conical, ending in a sharp point.

Type species.—*Bourgelatiooides traguli*, new species.

In many respects the worm for which this genus is erected resembles *Bourgelatia*, the single species of which was described from the intestine of pigs in Annam by Railliet, Henry, and Bauché (1919), but it differs in lacking an anterior leaf-crown and in other details of the mouth capsule, in the presence of a groove and overlying flaps in the cervical region, and in the presence of terminal

convoluted filaments on the spicules, a feature which, so far as I am aware, has not been described in any other nematode. Railliet, Henry, and Bauche suggested that *Bourgelatia* belonged with the Oesophagostominae, in spite of the absence of a ventral cervical groove, but Baylis and Daubney (1926) placed it with the Trichoneminae, since, as they point out, the ventral groove is the main distinguishing feature of the Oesophagostominae. Yorke and Maplestone (1926) likewise placed *Bourgelatia* with the Trichoneminae. *Bourgelatiooides*, on the other hand, although it resembles *Bourgelatia* in many ways, should probably be included with the Oesophagostominae, which it resembles both in the presence of a cervical groove and in the bursal formula. In this case the cervical groove completely encircles the body, however, and is not merely ventral. In my opinion the separation of the Trichoneminae and Oesophagostominae into separate subfamilies is of doubtful validity, but if the subfamily Oesophagostominae is to stand its definition should be changed so that the cervical groove is not limited to the ventral side.

BOURGELATIOOIDES TRAGULI, new species

Figures 2 and 3

Specific Diagnosis.—*Bourgelatiooides*: Coarse cylindrical worms, thickest near the middle, tapering gradually anteriorly from the middle, but tapering very little posteriorly except near the end of the body. Cuticle with very fine striations, more distinct in the female than in the male. Mouth capsule shallow, cylindrical, with heavily chitinized walls, and divided by an inner crown of 20 to 25 small leaflets into an anterior and posterior portion; anterior portion of capsule with four large papillae in the wall. Head about 67μ in diameter at the level of the posterior end of the buccal capsule. The groove and overlying flap which separate the head from the rest of the body are about 200μ from anterior end of body. Esophagus club shaped, about 550μ long.

Male 11.3 mm. long, with a maximum diameter of 420μ , tapering in the anterior 2 mm. and very gradually in the posterior $3\frac{1}{2}$ mm. of the body length. Bursa about as long as broad, about 240μ in either direction. Dorsal ray forked for about half its length, each fork again bifurcated for about half its length; externodorsals very large and thick, extending into the lateral lobes. Lateral rays all about equal in size, the posterolateral and mediolateral closely approximated and fused basally; ventral rays slightly smaller than the laterals, and closely approximated to each other, but split to the common base; all rays reach the edge of the bursal membrane. Spicules 655μ long, exclusive of the terminal filaments, about 24μ

in diameter near the base, then tapering to a fine point, but provided with broad striated alae; each spicule with a terminal long, convoluted filament.

Female 11.5 mm. long, with a maximum diameter of 460μ , tapering gradually in the anterior third and very gradually in the posterior third of the body, and tapering abruptly behind the anus to a sharp point. Anus about 200μ from tip to tail; vulva, provided with prominent lips, about 250μ anterior to the anus. Eggs in uterus about 77μ by 40μ , in early stages of segmentation.

Host.—*Tragulus javanicus* (Javan mouse deer).

Location.—Small intestine.

Locality.—Calcutta Zoological Garden, Calcutta, India.

Type specimens.—United States National Museum, helminthological collection No. 8097.

This worm in many respects resembles *Bourgelatia diducta*, described from the intestine of pigs in Annam by Railliet, Henry, and Bauche (1919). The worms, of which only one male and one female were collected, were found associated with a few specimens of *Haemonchus contortus*.

CYSTIDICOLA HARWOODI, new species

Figure 1

Specific diagnosis.—*Cystidicola*: Small slender worms, cylindrical for the greater part of their length, tapering at the ends. Cuticle rather coarsely striated at anterior end, the striations disappearing in both sexes near the level of the posterior end of the esophagus. Head truncated, 80μ to 85μ in diameter, with two blunt, rounded lateral lips and a pair of minute toothlike structures on the dorsal and the ventral side. The mouth opening is in the form of a dorso-ventral slit, the walls of the cylindrical vestibule appearing to come almost together in dorsal or ventral view, but spreading out into a funnel-shaped opening in lateral view. Vestibule 155μ to 160μ long and 10μ to 12μ in diameter, with thick chitinized walls. Esophagus slightly over 4 mm. long, in two parts, not sharply separated, and neither distinctly muscular; anterior portion 1.6 to 1.7 mm. long and about 52μ broad; posterior portion 2.4 to 2.6 mm. long and about 85μ broad. Nerve ring about 250μ to 350μ from anterior end of body. Excretory pore about 40μ behind nerve ring.

Male about 9 to 11 mm. long with a maximum diameter of about 120μ . Testis begins at about the junction of middle and posterior thirds of the body, passes forward with very slight convolution, turns backward some distance behind the end of the esophagus, and proceeds as a straight sperm duct to the cloaca. Cloacal aperture

140 μ to 145 μ from posterior end. Tail with narrow alae, provided with four pairs of preanal and three pairs of postanal papilla, all slender, and narrower at the base than at the tip. In some specimens an additional very narrow preanal papilla and a postanal papilla are visible. Tail bluntly pointed. Spicules unequal, the shorter one trowel-shaped, 135 μ to 145 μ long and 15 μ broad, the longer one 385 μ to 400 μ long and only about 7 μ to 8 μ broad for the greater part of its length, although it widens out to about 10 μ or 12 μ at the proximal end.

Female 14 to 16 mm. long with a diameter of about 285 μ . Vulva situated at approximately the center of the body. Vagina extends backward about 250 μ and then forks into an anterior and a posterior uterus filled with eggs. The ovaries are moderately convoluted, the loops of the anterior one extending forward to the region of the junction of the anterior and posterior portions of the esophagus, those of the posterior one extending almost to the posterior end of the tail. Tail very short and conical, the anus situated about 110 μ from the tip. Eggs oval, measuring about 42 μ by 26 μ , with thick shells but without the terminal filaments described by Leiper (1908) for *C. farionis*.

Host.—*Salvelinus fontinalis*.

Location.—Stomach.

Locality.—Near Elizabethtown, Adirondack Mountains, New York.

Type specimens.—United States National Museum, helminthological collection No. 8098; paratypes No. 8099.

These worms, members of the family Thelaziidae, were found by Mr. P. D. Harwood in considerable numbers in the stomachs of brook trout from Roaring Brook near Elizabethtown; all of nine specimens from that locality were infected. Nine other brook trout from Lily Pad Pond, in the same general neighborhood, were negative. A number of specimens of brown trout, *Trutta fario*, found in the same locality as the brook trout, were negative. This is the first record of a Cystidicola parasitic in the stomach; the type species, *C. farionis*, is an inhabitant of the air bladder, occasionally being found in the esophagus. The air bladders of these fish contained no parasites.

LITOMOSOIDES, new genus

Generic diagnosis.—Filariidae; Filariinae: Body slender and cylindrical, with cuticle very finely striated except at the extremities, where it is smooth. Head bluntly rounded, the mouth without lips or papillae. Oral vestibule a slender tube provided with thick chitinous walls; esophagus of moderate length, not divided into two portions, and straight except for a slight bulbous enlargement at the anterior end, into the anterior part of which the vestibule extends,

the anterior end of the esophagus being attached to the side walls of the vestibule. Vulva situated anteriorly behind the junction of the esophagus and intestine. Ovejector long, with a bulblike enlargement, with thick muscular walls at the vulvar end. Posteriorly the vagina opens into a thin-walled tube filled with embryos, which extends posteriorly a short distance and then splits into two uteri, which continue posteriorly almost to the anus. Tail of female long, rounded at the tip, without any embellishments. Posterior end of male coiled, with a long fingerlike tail, rounded at the tip, with a number of pairs of inconspicuous postanal papillae and no preanal papillae. Spicules very unequal, the longer one divided into a troughlike anterior part and a more slender posterior part which terminates in a filament. Shorter spicule troughlike, also with a terminal filament.

In many respects this genus is close to the genus *Litomosa* Yorke and Maplestone, 1926, but differs in the character of the oral vestibule and anterior end of the esophagus, in the position of the vulva, in the absence of processes at the tip of the tail in both sexes, and in the presence of postanal papillae.

Type species.—*Litomosoides sigmodontis*, new species.

LITOMOSOIDES SIGMODONTIS, new species

Figures 4, 5, 6, and 7

Specific diagnosis.—*Litomosoides*: Slender worms, cylindrical, tapering to a bluntly rounded head anteriorly, and to a rather elongate and slender conical tail posteriorly. Cuticle with very fine striations except near the ends of the body. Head truncated in dorsoventral view, unevenly rounded in lateral view, the mouth being situated somewhat toward the ventral side. Oral vestibule 20μ to 23μ long, with a narrow cylindrical lumen and heavily chitinized walls which do not have straight parallel sides externally, but are drawn out into points where the muscular fibers of the esophagus attach to it. Esophagus muscular, not divided into separate parts, 600μ to 660μ long, straight except for a bulbous enlargement anteriorly into which the posterior half of the vestibule is sunk. Females over twice as long as males.

Male about 24 to 28 mm. long with a maximum diameter of about 130μ to 140μ . Reproductive tube straight, without convolutions. Cloacal aperture about 180μ from tip of tail. Tail rounded at end, tapering for about half its length behind the cloacal aperture, and then almost cylindrical. No preanal papillae; four pairs of small postanal papillae, nearly equally spaced, the most distal one about midway between cloaca and tip of tail; first pair of papillae, nearest

the cloaca, very inconspicuous. Spicules unequal, the shorter one chitinized and trough-shaped for about three-fourths of its length, at which point it has an elbowlike projection; terminal portion membranous and very delicate; chitinized portion of spicule 75μ to 80μ long, total length, to end of membranous tip, 100μ to 105μ . Long spicule with total length of 185μ to 295μ ; proximal two-fifths trough-shaped, chitinized, followed by an apparent break, then a portion partly chitinous and partly membranous, ending finally in a delicate filament.

Female 50 to 65 mm. long, with a maximum diameter of about 300μ to 325μ . Vulva situated about 1.25 mm. from anterior end, about twice the length of the esophagus behind the anterior end of the worm. Vulva opens into a large, muscular, bulblike structure, from which a thick-walled muscular vagina, nearly 1 mm. in length, continues backward, and in many specimens loops forward again before changing to a thin-walled tube filled with embryos. The latter tube remains single for a length of about 300μ to 400μ before splitting into the two uteri. The latter continue almost to the anus as nearly straight tubes, only slightly convoluted by forward loopings. Tail very slender, terminal half with almost parallel sides, rounded at tip, about 625μ long.

Embryos in uterus about 100μ to 105μ long, unsheathed, with pointed tails.

Hosts.—*Sigmodon hispidus*, and white rat.

Location.—Thoracic cavity.

Locality.—Houston, Tex.

Type specimens.—United States National Museum helminthological collections, No. 8100, paratypes No. 8101.

This species is very close to *Filaria circularis* von Linstow, 1899, described from another rodent, "*Hesperomys sp.?*" from Porto Alegre, Southern Brazil, which now becomes *Litomosoides circularis* (von Linstow, 1899). Von Linstow's species differs from *L. sigmodontis* in a number of details, particularly in being relatively more slender, in the shorter tail of the male, in the presence of seven instead of four postanal papillae, and in the different size of the spicules. *L. sigmodontis* occurs in a high percentage of cotton rats in the vicinity of Houston and was found also in a white rat born and raised in the Rice Institute animal house, where some infected cotton rats were kept.

FILARIOPSIS ARATOR, new species

Figures 8, 9, and 10

Specific diagnosis.—*Filariopsis*: Body slender and cylindrical, with bluntly rounded extremities. Cuticle smooth with traces of very fine striation, but provided with an irregular, transparent excre-

tion which is thrown into rough, uneven fimbriae. (Fig. 10.) Some specimens are nearly entirely enclosed in this rough coat, while in others there are only occasional patches of the cuticle which are provided with it. Mouth provided with three inconspicuous lips. Esophagus short and muscular, about 250μ long.

Male about 50 to 60 mm. long with a diameter of about 210μ , uniform throughout nearly the whole length. Both ends of body bluntly rounded, the tail more bluntly than the head. Cloacal aperture only about 30μ to 35μ from tip of tail, the latter without alae or any distinct papillae, although there is a wartlike prominence just behind the cloacal opening. The spicules are short, equal, and converging at the tip, united by a membrane for the greater part of their length, and each ending in a single chitinous point. In lateral view they are strongly curved, like the blade of a sickle; the proximal ends, which are free, suggest the handles of a plow. They have a length of about 150μ . The gubernaculum is a single, thin, curved plate of chitin, appearing splinterlike in side view and slightly crescentic in optical section as seen in a ventral view of the worm.

Female about 80 to 90 mm. long, with a diameter, practically uniform for nearly the entire length of the body, of about 260μ . Posterior extremity bluntly conical, the anus almost terminal, less than 50μ from the tip. Vulva posterior, near anus, 130μ to 150μ from tip of tail. Uteri filled with embryos throughout a large part of the body; uterine embryos measured about 230μ to 280μ in length, with a diameter of about 12μ near the equator, the head bluntly rounded, the tail drawn out into a fine point.

Host.—*Cebus* species.

Location.—Lungs.

Locality.—Chicago, Ill.

Type specimens.—United States National Museum, helminthological collections No. 8120; paratypes No. 8121.

These worms were collected by Dr. W. H. Taliaferro in large numbers from the lungs of a number of specimens of South American monkeys captive in Chicago.

According to van Thiel's description, the type species, *F. asper*, differs in a number of important respects from the species here described, and it is possible that they may eventually have to be separated into different genera. The most significant differences are in the tail and spicules of the male. *F. asper* is described as having small alae and five pairs of papillae, whereas no such structures could be discerned in *F. arator*. The spicules of *F. asper* are described as separate structures, supported by two gubernacula, whereas in *F. arator* the spicules are united into a single plowlike structure and there is a single gubernaculum. The cuticle of *F. asper* "is covered by irregularly placed conical elevations, which, in the middle of the

body, measure 22.8μ by 11.4μ , but which are absent or very small on the head and tail." *F. arator*, on the other hand, has a cuticle roughened by what seems to be a hardened excretion; there is no regularity in the size of the elevations, and they are irregularly distributed in patches. Whether or not this roughness of the cuticle is comparable with that described by van Thiel, I am unable to determine. His figure of the protuberances does not in any way resemble the roughened cuticle of *F. arator*.

In spite of these differences, the two species show a number of striking resemblances. Both are parasites of the lungs of monkeys and are alike in general form, structure of the mouth and esophagus, position of the vulva, and the almost terminal position of the anus in both sexes, and in the form of the embryos. It is quite possible that other related forms will be found in the lungs of South American primates.

The genus *Filariopsis* was erected by van Thiel (1926) for a worm which was collected from the lungs of Surinam howler monkeys (*Alouata*=*Mycetes seniculus* Linnaeus), and referred by him to the Filariidae. The genus differs radically from typical filariae in the posterior position of the vulva, in the short muscular esophagus, and in the noncoiled tail of the male. It is possible, as suggested by Dr. M. C. Hall in correspondence, that the genus *Filariopsis* belongs with the spirurids rather than the filariids. Its posterior vulva suggests this, but its other peculiar characters—short muscular esophagus, three inconspicuous lips, and noncoiled, nonalate tail of the male—are no more characteristic of the spirurids than of the filariids. The lack of paired lips, the very slender body, the position in the host, and the uteri filled with microfilaria-like embryos are strongly suggestive of relationship with the filariae. The worm can not go into any of the families of Spirurata, either in the Spiruroidea or Filariodidea, as at present constituted, and a new family, Filariopsidae, is therefore proposed for it; this family is tentatively placed in the superfamily Filarioidea. The following definition is tentatively suggested for the family:

FILARIOPSIDAE, new family

Family diagnosis.—Filarioidea: Body very long and slender, cylindrical for nearly its entire length. Mouth surrounded by three lips, which may be very inconspicuous; no chitinized buccal cavity. Esophagus short, thick, and muscular. Cuticle without distinct striations, but with conical elevations or a roughness produced by a hardened secretion. Tail of male very short, not coiled, and with very small alae or none at all, with or without papillae. Spicules equal, sometimes united; gubernaculum present, either single or

paired. Vulva of female shortly anterior to the anus. Uteri filled with large numbers of embryos. Parasitic in lungs of mammals.

Type genus.—*Filariopsis* van Thiel, 1926. It is possible that the genus *Oslerus* Hall, 1921, also belongs to this family.

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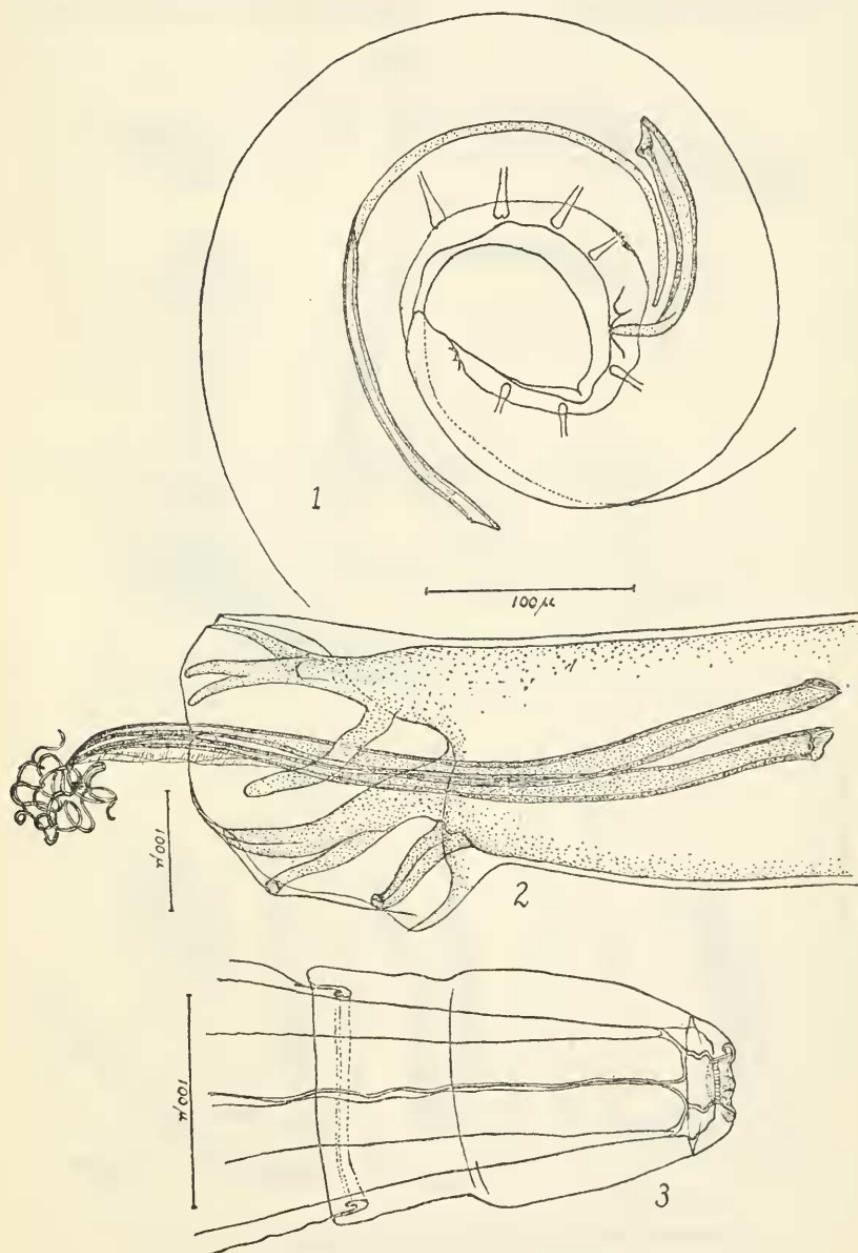
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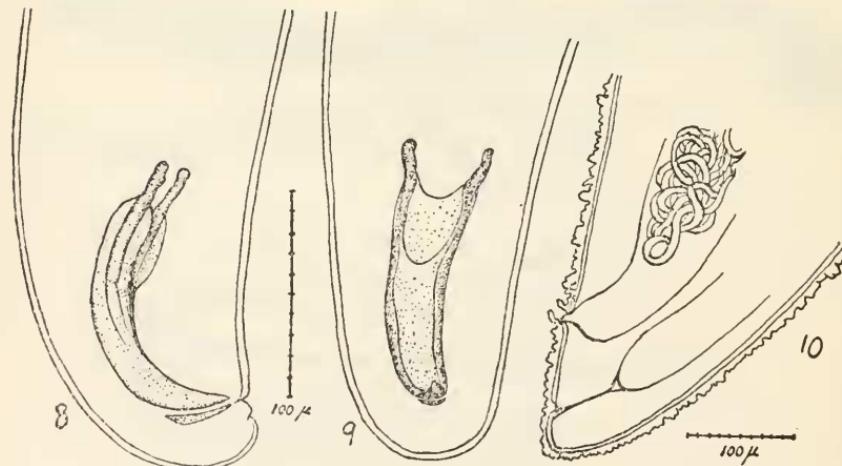
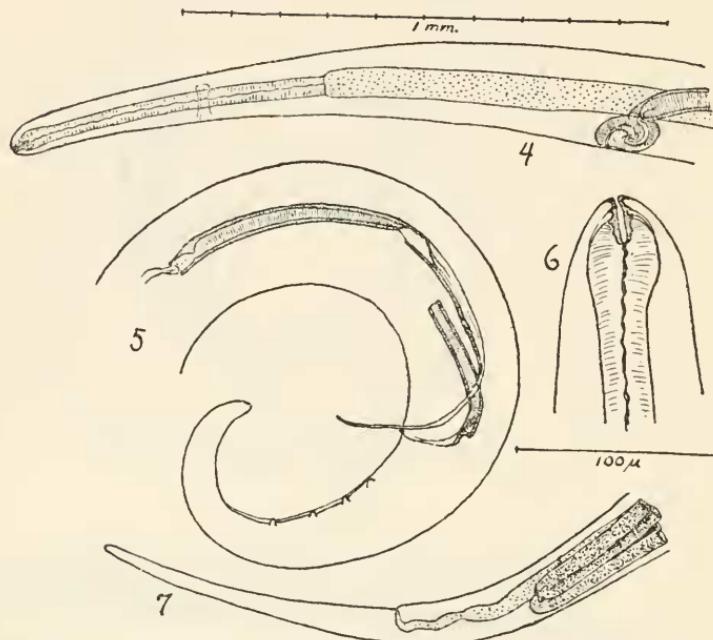
EXPLANATION OF PLATES

PLATE 1

FIGURE 1. *Cystidicola harwoodi*. Posterior end of male.
2. *Bourgelatiooides traguli*. Posterior end of male.
3. *Bourgelatiooides traguli*. Head.



CYSTIDICOLA HARWOODI AND BOURGELATIOIDES TRAGULI
FOR EXPLANATION OF PLATE SEE PAGE 10.



LITOMOSOIDES SIGMODONTIS AND FILARIOPSIS ARATOR
FOR EXPLANATION OF PLATE SEE PAGE 11.

PLATE 2

FIGURE 4. *Litomosoides sigmodontis*. Anterior end of female.
5. *Litomosoides sigmodontis*. Posterior end of male. (Magnification same as figure 6.)
6. *Litomosoides sigmodontis*. Head, much enlarged.
7. *Litomosoides sigmodontis*. Posterior end of female. (Magnification same as figure 6.)
8. *Filariopsis arator*. Posterior end of male, lateral view.
9. *Filariopsis arator*. Posterior end of male, ventral view.
10. *Filariopsis arator*. Posterior end of female.